What is claimed is:

1. A method for correcting a proximity effect applied to a dose of an electron beam exposure, comprising:

classifying an underlying pattern of a level underlying a

5   thin film layer;

dividing a processing pattern to be transferred on the thin film layer into a first pattern overlapping with the underlying pattern and a second pattern which does not overlap with the underlying pattern according to the classified underlying pattern;

10   calculating a pattern area density for the first and second patterns in a unit region; and

calculating a corrected dose for the processing pattern according to the pattern area density.

15   2. The method of claim 1, wherein the processing pattern is exposed by the electron beam exposure.

3. The method of claim 1, wherein the processing pattern is divided by use of a graphic logic operation process.

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4. The method of claim 2, wherein the corrected dose of a proximity effect of the electron beam exposure is expressed by a dose correction equation having a linear connection of the pattern area densities.

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5. The method of claim 4, wherein the dose correction equation is

expressed by use of a pattern area density of the processing pattern,
a ratio of backscattered energy to irradiation energy of the
electron beam exposure in an area without the underlying patterns,
the pattern area density of the first pattern divided according

5   to the k-th (k= 1 to n) underlying patterns, and a ratio of
backscattered energy to irradiation energy of the electron beam
exposure according to the k-th underlying patterns.

6.   The method of claim 5, wherein the dose correction equation is

10   expressed as below

$$D = \frac{C}{\left\{\frac{1}{2} + \eta\left[\alpha + \sum_{k=1}^{n}\left(\frac{\eta_k}{\eta} - 1\right)\alpha_k\right]\right\}}$$

where the corrected dose is D, the pattern area density of the
processing pattern is α, the ratio of backscattered energy to
irradiation energy of the electron beam exposure in the region

15   without the underlying patterns is η, the pattern area density of
the first pattern divided according to the k-th (k= 1 to n)
underlying patterns is α_k, the ratio of backscattered energy to
irradiation energy of the electron beam exposure according to the
k-th underlying patterns is η_k, and C is a constant.

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7.   The method of claim 4, wherein, the pattern area density for
the k-th underlying patterns is calculated by use of a unit region
corresponding to a length less than a backscattering distance of
electrons irradiated by the el ctron beam exposure.

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8. An exposure method, comprising:

preparing a substrate having a thin film layer deposited on a surface of an underlying layer, the underlying layer having an

5 underlying pattern;

coating a resist film on the thin film layer;

obtaining a processing pattern configured to delineate on the resist film, and the underlying pattern;

classifying the underlying pattern;

10 dividing the processing pattern into a first pattern which overlaps with the underlying pattern and a second pattern which does not overlap with the underlying pattern, according to the classified underlying pattern;

calculating a pattern area density for the first and second

15 patterns in a unit region;

calculating a corrected dose for the processing pattern based on the pattern area density; and

exposing the resist film by the corrected dose.

20 9. The exposure method of claim 8, wherein the processing pattern is exposed by an electron beam exposure.

10. The exposure method of claim 8, wherein the processing pattern is divided by use of a graphic logic operation process.

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11. The exposure method of claim 9, wherein the corrected dose of

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a proximity effect of the electron beam exposure is expressed by a dose correction equation having a linear connection of the pattern area densities.

5   12. The exposure method of claim 11, wherein the dose correction equation is expressed by use of a pattern area density of the processing pattern, a ratio of backscattered energy to irradiation energy of the electron beam exposure in an area without the underlying patterns, the pattern area density of the first pattern

10   divided according to the k-th (k= 1 to n) underlying patterns and a ratio of backscattered energy to irradiation energy of the electron beam exposure according to the k-th underlying patterns.

13. The exposure method of claim 12, wherein the dose correction

15   equation is expressed as below

$$D = \frac{C}{\left\{ \frac{1}{2} + \eta \left[\alpha + \sum_{k=1}^{n} \left(\frac{\eta_k}{\eta} - 1 \right) \alpha_k \right] \right\}}$$

where the corrected dose is D, the pattern area density of the processing pattern is α, the ratio of backscattered energy to irradiation energy of the electron beam exposure in the region

20   without the underlying patterns is η, the pattern area density of the first pattern divided according to the k-th (k= 1 to n) underlying patterns is α_k, the ratio of backscattered energy to irradiation energy of the electron beam exposure according to the k-th underlying patterns is η_k, and C is a constant.

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14. The exposure method of claim 9, wherein the pattern area

density for the k-th underlying patterns is calculated by use of

a unit region corresponding to a length less than a backscattering

5   distance of electrons irradiated by the electron beam exposure.

15. A manufacturing method of a semiconductor device, comprising:

    forming an underlying pattern of an underlying layer on a

semiconductor substrate;

10   depositing a thin film layer in a surface of the underlying

layer;

    coating a resist film on the thin film layer;

    loading the semiconductor substrate on a movable stage of

an electron beam exposure apparatus;

15   calculating a corrected dose by the steps of classifying the

underlying pattern, dividing a processing pattern to be delineated

on the resist film into an first pattern which overlaps with the

underlying pattern and a second pattern which does not overlap with

the underlying pattern according to the classified underlying

20 pattern, calculating a pattern area density for the first and second

patterns in a unit region, and calculating a corrected dose for

the processing pattern based on the pattern area density;

    exposing the resist film by the corrected dose;

    developing the resist film; and

25   processing the thin film layer by use of the developed resist

film as a mask and transferring the processing pattern onto the

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thin film layer.

16. The manufacturing method of claim 15, wherein the processing pattern is exposed by an electron beam exposure.

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17. The manufacturing method of claim 15, wherein the processing pattern is divided by use of a graphic logic operation process.

18. The manufacturing method of claim 16, wherein the corrected

10 dose of a proximity effect of the electron beam exposure is expressed by a dose correction equation having a linear connection of the pattern area densities.

19. The manufacturing method of claim 18, wherein the dose

15 correction equation is expressed by use of a pattern area density of the processing pattern, a ratio of backscattered energy to irradiation energy of the electron beam exposure in an area without the underlying patterns, the pattern area density of the first pattern divided according to the k-th (k= 1 to n) underlying patterns

20 and a ratio of backscattered energy to irradiation energy of the electron beam exposure according to the k-th underlying patterns.

20. The manufacturing method of claim 19, wherein the dose correction equation is expressed as below

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$$D = \frac{C}{\left\{ \frac{1}{2} + \eta \left[\alpha + \sum_{k=1}^{n} \left(\frac{\eta_k}{\eta} - 1 \right) \alpha_k \right] \right\}}$$

where the corrected dose is D, the pattern area density of the processing pattern is α, the ratio of backscattered energy to irradiation energy of the electron beam exposure in the region

5   without the underlying patterns is η, the pattern area density of the first pattern divided according to the k-th (k= 1 to n) underlying patterns is α_k, the ratio of backscattered energy to irradiation energy of the electron beam exposure according to the k-th underlying patterns is η_k, and C is a constant.

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21.   The manufacturing method of claim 16, wherein the pattern area density for the k-th underlying patterns is calculated by use of a unit region corresponding to a length less than a backscattering distance of electrons irradiated by the electron beam exposure.

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22.   A proximity correction module, comprising:

an area density calculation unit configured to classify an underlying pattern of an underlying layer, to divide a processing pattern to be delineated on a thin film layer formed in a surface

20   of the underlying layer according to the classified underlying pattern into a pattern overlapping with the underlying pattern and a pattern not overlapping therewith and to calculate a pattern area density for each of the divided processing patterns in a unit region;

an area density map memory configured to store a position

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of the unit region and the pattern area density of each of the divided

processing patterns; and

a dose correction calculation unit configured to calculate

a corrected dose for the processing pattern based on the pattern

5 area density.